# User-Space Network Tunneling Under a Mobile Platform: A Case Study for Android Environments

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**Abstract.** The IoT ecosystem is taking the whole ICT world by storm and, in particular for currently hot topics such as Smart Cities, it is becoming one of the key enablers for innovative applications and services. When talking about end users, or even citizens, mobiles enter the picture as the ultimate personal gadget, as well as relevant outlets for most of the duties (sensing, networking, edge computing) IoT devices are typically envisioned in the first place. Smartphones, tablets and similar accessories are even more powerful in terms of hardware capabilities (and function diversity) than typical embedded systems for IoT, but it is typically the software platform (e.g., the OS and SDK) which limits choices for the sake of security and control on the user experience. Even a relatively open environment, such as Android, exhibits these limits, in stark contrast to the otherwise very powerful and feature-complete functionalities the underlying system (i.e., Linux) natively supports. In this work the authors describe a fully user-friendly and platform-compliant approach to let users break free from some of these limitations, in particular with regard to network virtualisation, for the purpose of extending an IoT-ready Smart City use case to mobiles.

**Keywords:** Stack4Things · OpenStack · Fog computing · IoT · Cloud · Network virtualization · VPN · Reverse tunneling

## 1 Introduction

Information and communication technologies (ICT) and solutions are progressing very quickly, radically changing the landscape. Recent trends, on the one hand, pushed towards more and more powerful computing infrastructure such as the Cloud ones, providing customizable computational resources as services through the Internet, elastically, on demand. This allowed to think about new offloading patterns where business logic processing is outsourced, ubiquitously offloaded to remote server while lightweight thin client are running on local


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